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FOR: Cheek Path Airway And Cheek Pouch Anchor

APPLICATION FOR PATENT

Commissioner of Patents and Trademarks  
Washington, D.C. 20231

Sir:

1 The following is an original application for patent.

2 Title of Invention: Cheek Path Airway And Cheek Pouch Anchor.

3 Related Applications. There are no related applications.

4 Statement Regarding Federally Sponsored Research or Development.

5 No federally-sponsored research and development is involved.

6 BACKGROUND OF THE INVENTION.

7 Field of the Invention.

8 The field of the invention is oral conduits for fluids,  
9 including oral airways.

10 Description of Related Art.

11 Nasal Breathing Restrictions.

12 Some persons at times breathe nasally during sleep, with the  
13 lips and jaws closed, thereby eliminating the mouth as an effective  
14 airway. Closed-mouth, nasal breathing through restricted nasal air  
15 ways reduces ventilation volume and can impair breathing and sleep.

16 Restrictions in the nasal airway path may significantly  
17 contribute to breathing insufficiency during sleep in some persons  
18 who breathe nasally with lips closed. Scientific and medical

1 experts have reported (or hypothesized) a variety of contributing  
2 and causal factors other than nasal airway restriction for hypopnea  
3 and apnea, such as sagging of the base of the tongue, and possibly  
4 the lower jaw, towards the throat, resulting in restriction or  
5 blockage of the throat air way. Nasal restrictions may contribute  
6 to snoring and to sleep apnea.

#### 7 Jaw and Tongue Control Devices.

8 A variety of devices has been developed and patented by others  
9 to mechanically control a user's jaw and tongue positions to  
10 minimize sagging of tongue and mandible towards the user's throat  
11 airway. Some include oral airways. Others are designed to  
12 function during closed-mouth, nasal breathing.

13 It is an objective of the instant cheek airway invention that  
14 it be capable of placement and use in combination with a wide  
15 variety of exiting jaw- and tongue-control devices, though perhaps  
16 with some modification of such devices.

#### 17 Tongue-control Devices.

18 A non-exhaustive list of examples of tongue-control devices  
19 that incorporate airways or employ positive or negative air  
20 pressure is:

21 Alvarez, et al., U.S. Patent No. 5,465,734 (1995); Hart, U.S.  
22 Patent No. 5,957,133 (1999); Karell, U.S. Pat. No. 6,408,851 B1,  
23 discloses a tongue-fastening device having airway 40 and two or  
24 more internal airway openings 42 which, as depicted in Karell's  
25 figures 3 and 5, pass between the teeth. Kulick, Pub. No.: US  
26 2002/0139375 A1 holds the tongue forward by suction, uses bite  
27 blocks 2 to prevent biting the tongue and support air passages 4  
28 into the oral cavity. Nelson, U.S. Pat. 6,244,865 B1, discloses a  
29 tongue positioning device which includes a hollow passageway 20 in  
30 the mouthpiece for flow of breathing gasses into the mouth.

#### 31 Mouthpieces and Lip-Passing Tubes.

32 There exists an enormous variety of mouthpieces and other  
33 devices for delivery of gasses past the user's lips into the user's  
34 mouth. Examples include snorkels and SCUBA (Self-Contained  
35 Underwater Breathing Apparatus) mouthpieces, as well as tubes,  
36 cannulae and ventilators used in medicine, surgery, anaesthesia,  
37 orthodontics, and sports. There also are numerous devices designed

1 to ameliorate some aspect of nasal congestion, snoring, hypopnea  
2 and apnea. Some airway devices simply provide conduits to external  
3 air at ambient pressure, whereas others are designed to deliver  
4 gasses at modified pressures. Examples of the latter are CPAP  
5 (Continuous Positive Airway Pressure) and BiPAP (Bi-level Positive  
6 Airway Pressure) machines.

7 Many existing oral airways pass between a user's maxillary and  
8 mandibular teeth, requiring bite blocks or other devices to prevent  
9 crushing of the airway between the teeth and thus restricting the  
10 user's jaw motion.

11 Devices Using Portions of the Cheek Pathway.

12 Nelson, in a series of U.S. Patents No. 4,170,230, (1979),  
13 4,261,354 (1981), 4,262,666 (1981) and 4,289,127 (1981), discloses  
14 several different versions of hollow tubes which traverse portions  
15 of a user's cheek pathway. Nelson's devices are designed for  
16 stand-alone cheek-side positioning; that is, they are not anchored  
17 to teeth-engaging or palate-engaging dental devices. Nelson does  
18 not disclose any structure curving around a user's rear-tooth  
19 corner, or passing into or through a user's rear-jaw gap, or  
20 extending from the user's rear-jaw gap over the user's tongue into  
21 airspace in a user's rear-mouth cavity. Nelson describes and  
22 depicts his curved tube as open-ended, with at least one opening  
23 internal to the user's mouth, and having a length to insure that  
24 there will be an air flow opening approximate the molars at the  
25 rear of the user's mouth. See, for example, Nelson, U.S. Patent  
26 4,170,230, abstract; column 1:25 - 38; column 2:55 - 67; column  
27 3:19 - 35; column 4: 5 - 14; claims 1 and 6; and figs. 1, 2, 3, 5  
28 and 7. Nelson's disclosure states that the air flow opening(s) of  
29 Nelson's tube "pass the air from the tube to the rear of the mouth  
30 and upper trachea." Since Nelson does not disclose any tube  
31 structure dorsal of the user's molars, Nelson leaves a reader to  
32 guess the path which air traverses after exiting Nelson's tube  
33 "approximate the molars." Nelson, U.S. Patent No. 4,170,230,  
34 column 1, lines 44 - 47; column 4, lines 5 - 13; and abstract.

35 Nelson's patents, and especially U.S. Patent No. 4,289,127  
36 (1981), also disclose various cheek-side stabilizing devices  
37 including fin-like, wire-like and rod devices. Nelson describes

1 his cheek-side stabilizing devices as rigid or flexible or  
2 malleable, but does not describe them as resilient or spring-like.

3 Pope and Hawkins, U.S. Patent 4,553,549, disclose a "pressure  
4 equalization conduit" attached to an orthopedic/orthodontic  
5 appliance for treating neuromuscular imbalance which is positioned  
6 "so that the tube extends along the outside surface of the teeth  
7 around the posterior of the teeth to the position which is in  
8 communication with the pharyngeal cavity." Pope, et al., U.S.  
9 Patent 4,553,549, specification col. 3:10-20 and claim 13. (Pope's  
10 "posterior" presumably corresponds to dorsal.) In contrast with  
11 Nelson's cheek-side tubes, the pressure equalization conduit of  
12 Pope, et al., is not disclosed as a self-contained device designed  
13 to stand alone in a cheek pathway. Rather, the Pope conduit is  
14 positioned by wire holders that are embedded in the teeth- and  
15 palate-engaging elements of the Pope orthopedic/orthodontic device.  
16 Pope et al. U.S. Patent 4,553,549, col. 5:60-68. At least one  
17 version of the Pope conduit is disclosed and is explicitly claimed  
18 as having "inside diameter of from about 2 to 3 mm." Pope,  
19 Specification, 3:30-40 and claim 16. However, Pope, et al. do not  
20 state limiting diameters.

#### 21 Brief Summary of the Invention.

22 This application discloses a cheek path airway and a cheek  
23 pouch anchor. In a preferred version, they are combined with each  
24 other, but each also could be used alone or in combination with  
25 other prior art devices. Such other prior art devices include jaw  
26 control and tongue control devices.

27 Summary of Cheek Path Airway Invention. The cheek path airway  
28 is a hollow tube or channel configured, or adjustable, to act as a  
29 conduit for air or other fluids along a user's "cheek pathway." A  
30 user's "cheek pathway" is defined more precisely below.

31 The cheek path airway bypasses nasal airways and provides oral  
32 air flow supplemental to nasal flow, even though the user's lips,  
33 teeth and jaws are otherwise closed. Thus, the cheek path airway  
34 can provide supplemental air volumes to mitigate breathing  
35 impairment caused by restriction of a user's nasal airways without  
36 a user having to switch to open-mouth breathing.

37 The cheek path airway's curve from the cheek-side to the

1 dorsal side of a user's rear-most teeth helps constrain rotational  
2 and translational motions of the airway tube in a user's mouth.  
3 When a user's jaws are opened the cheek path airway alone (without  
4 the cheek pocket anchor) remains somewhat vulnerable to rotating or  
5 sliding between the biting surfaces of a user's teeth. The airway  
6 can be built to mitigate such motions by using a relatively stiff  
7 (or stiffly flexible) curve through the user's rear-jaw gap, and by  
8 forming (or flexing) the tongue portion of the airway to conform  
9 relatively stiffly to the side and roof of the user's rear-mouth  
10 cavity, while more rigid portions of the airway extend along the  
11 inner wall of a user's cheek and between a user's lips.

12 The cheek path airway can be made flexible or moldable at  
13 strategic positions along its longitudinal axis so that the action  
14 of the user's tongue and jaws will press the airway into locations  
15 of lesser interference with movements of the user's tongue and  
16 rear-jaw gap, thus achieving better fit and stability.

17 External extensions of the cheek path airway, which curve  
18 about the outside corner of a user's mouth and traverse along the  
19 user's external cheek wall, can be employed to further constrain  
20 the airway in a cheek pathway. Stability can be further improved  
21 by an external extension which folds about a user's ear.

22 A dual cheek path airway, which traverses the two cheek  
23 pathways on either side of a user's mouth, can further increase  
24 stability as well as increasing air flow volume and providing  
25 redundant conduits.

26 More positive control over destabilizing motions of a cheek  
27 path airway can be achieved by combining the cheek path airway with  
28 a cheek pouch anchor.

29 Summary of Cheek Pouch Anchor Invention. The cheek pouch  
30 anchor is a spring element which is adapted to be placed within a  
31 user's "cheek pouch," an area which lies between the inner wall of  
32 a user's cheek and such user's gums and teeth as more precisely  
33 defined elsewhere in this disclosure. The cheek pouch anchor of  
34 the instant invention can expand and compress in a resilient or  
35 spring-like manner within a user's cheek pouch as a user opens and  
36 closes the user's jaws. A cheek pouch anchor can better maintain a  
37 cheek path airway's positioning while avoiding the more-mobile

1 ventral portions of a user's tongue, avoiding the biting surfaces  
2 of the user's teeth, resisting expulsion from the user's mouth, and  
3 mitigating risks of choking and gagging.

4 The cheek pouch anchor invention is capable of receiving  
5 joinder to a work piece that is to be positioned at least partially  
6 within such user's cheek pouch. The cheek path airway is one type  
7 of work piece that can be joined to the cheek pouch anchor.

8 It is conceived that the cheek pouch anchor could be  
9 impregnated or coated with substances that are intended to be  
10 released over time within a user's mouth, or it could carry and  
11 position containers and other devices at least partially within a  
12 user's cheek pouch.

#### 13 Summary of Combination of Cheek Path Airway and Cheek Pouch 14 Anchor Inventions.

15 The combination of the cheek path airway and the cheek pouch  
16 anchor provides additional constraints upon rotations and  
17 translations of the cheek path airway, beyond the constraints built  
18 into the cheek path airway itself, which render the combination  
19 more suitable for use during sleep.

20 Summary of Combination of Cheek Path Airway With Existing Jaw-  
21 and Tongue-Control Devices. The cheek path airway can be used  
22 (with or without the cheek pouch anchor) in combination with a  
23 mandibular jaw control device that restricts sagging of a user's  
24 mandible toward such user's throat airway during sleep for the  
25 purpose of mitigating throat airway impairment and sleep apnea. It  
26 is conceived that the cheek path airway also could be used in  
27 combination with many other dental, jaw, and tongue control  
28 devices. The cheek path airway can functionally leverage itself  
29 against a dental device installed in a user's mouth so as to  
30 improve the airway's stability within the cheek pathway, but  
31 without substantial impairment of the function of such dental  
32 device, so that the combination functions cooperatively to mitigate  
33 a user's breathing problems.

34 Some Special Anatomical Definitions. The following  
35 definitions have been created for the purposes of this disclosure  
36 and the claims:

37 "User" means the creature using a device, generally a human,

1 though devices in principle could be used by creatures other than  
2 humans.

3 "User's anterior-posterior axis" means head to foot for a  
4 human user, head to tail for other creatures. Sometimes also  
5 called a "vertical" axis when a human is viewed standing upright.

6 "User's dorsal-ventral axis" means back to front, that is,  
7 with a human user's face in front; such axis is approximately  
8 horizontal when an upright human user is viewed. Also sometimes  
9 referred to as front and rear.

10 "User's cheek pathway", sometimes abbreviated to "cheek  
11 pathway" or "cheek path", means the pathway, traversing in either  
12 direction, from (1) outside the user's mouth, (2) between such  
13 user's lips, (3) between such user's inner cheek wall and the  
14 cheek-adjacent side of such user's dental arches, gums and teeth,  
15 and (4) at least around the cheek-side rear tooth corner of such  
16 user's rear-most tooth or teeth from cheek side to dorsal side of  
17 such tooth. The cheek pathway can be further extended (5) from the  
18 user's cheek-side rear tooth corner through such user's rear-jaw  
19 gap, and yet further extended (6) from such user's rear-jaw gap  
20 over such user's tongue into the airspace in such user's rear-mouth  
21 cavity. The cheek pathway avoids the biting (occlusal) surfaces of  
22 a user's teeth.

23 "User's cheek pouch" lies between the inner wall of one of  
24 such user's two cheeks and the cheek-adjacent side of such user's  
25 dental arches, gums and teeth. A user's cheek pouch extends along  
26 such user's anterior-posterior ("vertical") body axis between the  
27 junctures of such user's mandibular and maxillary dental arches  
28 with such user's inner cheek wall. Such cheek pouch extends along  
29 such user's dorsal-ventral body axis approximately from a user's  
30 front teeth to the general area of such user's most-dorsal teeth  
31 and rear-jaw gap. The configuration of a user's cheek pouch  
32 dynamically alters as the user's jaws and lips open and close. A  
33 user has two cheek pouches located on opposing sides of a user's  
34 mouth.

35 "User's cheek-side position" means a location adjacent to a  
36 user's inner cheek wall, within the user's cheek pouch, in which a  
37 device can be placed.

1 "User's rear-jaw gap" or "rear-jaw space" means the space  
2 remaining open between such user's mandible (lower jaw) and maxilla  
3 (upper jaw) dorsally of such user's rear-most tooth or teeth when  
4 such user's jaws are closed. The size and shape of the rear-jaw  
5 gap will vary from person to person. It is sufficiently large in  
6 some persons to accommodate a cheek path airway. Sometimes the  
7 rear-jaw gap has been enlarged by extraction of at least one of the  
8 person's wisdom teeth. A user's rear-jaw gap also can be  
9 artificially enlarged by dental devices which partially block the  
10 user's bite and prevent complete closure of the user's jaws. A  
11 user generally will have two rear-jaw gaps, one on each side of the  
12 user's head.

13 "Air" as used herein includes any gasses or other fluids for  
14 inhalation and exhalation by humans or other creatures. "Air"  
15 could include natural environmental air at atmospheric or other  
16 pressure and partially or wholly modified gasses and fluids such as  
17 supplemental oxygen, mixtures of gasses, aerosols, and oxygenated  
18 fluids, whether or not at atmospheric pressure. It is conceived  
19 that the cheek path airway could conduct fluids other than "air",  
20 including without limitation, pharmaceutical and anesthetic gasses.

#### 21 22 THE PROBLEMS ADDRESSED BY THE INVENTION.

23 Nasal air way restriction causes a variety of adverse effects,  
24 ranging from the merely uncomfortable to life threatening. The  
25 mouth provides an alternate, natural breathing airway, but not  
26 when a person's lips are closed.

27 Many airway devices use a mouth pathway to bypass restricted  
28 nasal passages. All airways which use a mouth pathway must be  
29 stabilized in the mouth to mitigate risks of gagging and choking  
30 and to prevent ejection from the mouth or displacement within the  
31 mouth. These problems of stable positioning of a mouth airway are  
32 particularly critical while a user is asleep or otherwise is  
33 unconscious. The instant invention mitigates stability problems of  
34 stand-alone cheek-side airways. It also mitigates blockage of air  
35 flow openings.

36 All mouth airway devices must use materials which are  
37 essentially non-toxic to the user, and the instant invention is



1 intended to do so.

2 Most mouth airway devices are "central mouth" airways which  
3 pass between the biting surfaces of a user's teeth. Such devices  
4 thus must use some form of bite block to prevent closing of the  
5 user's jaws and teeth from crushing the airway. The instant  
6 invention can function with or without a bite block in place.

7 Many central airway devices are anchored by dental devices  
8 that engage the user's teeth or dental arches or palate. Such  
9 devices create a potential for undesired orthodontic effects from  
10 the airway anchoring and from bite blocking. One  
11 orthopedic/orthodontic device is designed to be installed within a  
12 user's maxillary dental arch to actively modify a user's mouth  
13 anatomy, and it also includes a "pressure equalization conduit"  
14 which is positioned in a cheek pathway. Pope et al., U.S. Patent  
15 4,553,549. Use of dental anchoring adds complexity and expense to  
16 a cheek path airway device and tends to encumber a user's jaw and  
17 tongue movements. It is desirable to have a mouth airway which by-  
18 passes, and is not anchored to, a user's teeth or palate.

19 The airway of the instant invention bypasses, and is not  
20 anchored to, a user's teeth or palate. It avoids the more-mobile  
21 ventral portions of a user's tongue and enables the more dorsal  
22 portions of a user's tongue to press the airway into positions of  
23 lesser interference with the tongue's movements in the user's rear-  
24 mouth cavity.

25 It can be desirable to preserve some nasal breathing even when  
26 nasal passages are restricted. Nasal passages provide a variety of  
27 desirable natural breathing features such as filtering, warming and  
28 moisturizing the air, and avoidance of high volumes of air flow  
29 past teeth, gums and tongue. It also is desirable to have a mouth  
30 airway which allows the user's lips to nearly seal about it so as  
31 to route air through the airway and avoid open-mouth breathing.  
32 Full open mouth breathing causes "dry mouth" discomfort. Because  
33 the open mouth provides such a large pathway, open mouth breathing  
34 tends to nearly pre-empt nasal breathing, especially if the nasal  
35 passages are restricted. Some mouth airway devices aim to function  
36 as a complete alternative to nasal breathing while avoiding full  
37 open-mouth breathing. For example, Nelson's tube is designed so

1 that "the flow of air therefrom will be approximate to that flow of  
2 air as could be expected from normal nasal breathing," ( Nelson,  
3 U.S. Patent 4,170,230, Abstract).

4 The instant invention is designed to supplement, but not  
5 necessarily to replace, nasal breathing. It thus can help preserve  
6 some nasal breathing. It can function during periods of restricted  
7 nasal breathing before a user has switched from closed-mouth nasal  
8 breathing to open-mouth breathing.

9 Problems with Cheek-side Positioning of Airways.

10 Some mouth airways, herein called "cheek-side" airways, are  
11 designed for placement between the inner wall of a user's cheek and  
12 a user's cheek-adjacent gums and teeth in order to avoid the biting  
13 surfaces of a user's teeth and the user's tongue. This "cheek-  
14 side" location is only a portion of what is defined in this  
15 disclosure as a full "cheek pathway". The Nelson airways, U.S.  
16 Patents No. 4,170,230, (1979), 4,261,354 (1981), 4,262,666 (1981)  
17 and 4,289,127 (1981), for example, are designed to lie in a cheek-  
18 side position.

19 Cheek-side Air-flow Openings Subject to Blockage and Saliva  
20 Drainage. Air-flow openings placed in a cheek-side position are  
21 subject to blockage by the user's cheek, gum and tooth tissues and  
22 by mouth liquids. They also tend to drain liquids into the airway  
23 tube and out of the user's mouth. As a result, there is a  
24 relatively small margin for error in cheek-side positioning of air  
25 flow openings.

26 A user's inner cheek wall naturally, resiliently drapes over  
27 the cheek-adjacent side of a user's dental arches, teeth and gums.  
28 It will tend to drape over an airway device in a cheek-side  
29 position, urging the airway against the user's dental arches, gums  
30 and teeth. This draping effect can cause blockage of cheek-side  
31 air flow openings by the user's tissues, but the draping effect  
32 also provides forces that can be utilized to stabilize cheek-side  
33 devices.

34 The instant invention mitigates blockage of air flow openings  
35 by curving the cheek path airway around the user's rear-tooth  
36 corner from cheek side to dorsal side. This curve either exposes  
37 the airway's internal open tip to the user's rear-jaw gap, or,

1 preferably, enables projection of the airway's internal open tip  
2 through the user's rear-jaw gap and over the user's tongue within  
3 the airspace in the user's rear-mouth cavity. The larger airspace  
4 volume within a user's rear-mouth cavity provides a larger margin  
5 of error in placement of air flow openings than does a cheek-side  
6 positioning of air flow openings adjacent to a user's teeth and  
7 gums. This positioning also tends to mitigate exposure of the tube  
8 opening to saliva and other mouth liquids.

9 Slippage and Rotation Problems of Cheek-side Airways.

10 Cheek-side airways have numerous modes of potentially  
11 undesirable motion, including the three axes of translational  
12 motions (anterior-posterior, dorsal-ventral, and side-to-side or  
13 "lateral"), as well as the three modes of rotational motion (roll,  
14 pitch and yaw).

15 Undesirable motions of a cheek-side airway include: slippage  
16 of the device between the biting surfaces of a user's teeth;  
17 interference with the user's tongue motions; slippage into gagging  
18 or choking positions; dorsal-ventral slippage of the device between  
19 the user's lips, and expulsion from the user's mouth.

20 In Nelson's tubes, for example, undesirable rotation of the  
21 tube caused blockage of air openings by the user's mouth tissues.  
22 Nelson's tubes also were subject to dorsal-ventral slippage.  
23 Nelson, U.S. Patent 4,289,127, col. 1:35-45. Nelson developed  
24 cheek-side stabilizing devices to mitigate undesirable rotational  
25 motions (see particularly U.S. Patent 4,289,127), as well as to  
26 prevent dorsal-ventral slippage and impairment of the user's lip  
27 seal (see U.S. Patents 4,170,230, 4,261,354, 4,262,666, 4,275,725,  
28 and 4,289,127).

29 Fixed-span cheek-side stabilizing devices, such as the fin-  
30 like, wire-like and rod devices of Nelson, have a potentially  
31 disabling instability problem. Such fixed-span devices cannot  
32 dynamically adjust to maintain a span across the gap (inter  
33 occlusal space) created between a user's maxillary and mandibular  
34 teeth as the user's jaws open. However, a user's jaws sometimes  
35 can open beyond that fixed-span height, allowing the fixed-span  
36 device to rotate or slip between the biting (occlusal) surfaces of  
37 the user's teeth.

1        Suppose, by way of hypothetical illustrative example, that the  
2 heights of a user's mandibular and maxillary dental arches are 1.75  
3 cm each (measured from their respective junctures with the user's  
4 inner cheek wall to the biting surfaces of their respective teeth).  
5 The vertical height of such user's cheek pocket, when the user's  
6 jaws are closed, is the sum of the heights of the user's dental  
7 arches, that is, 3.5 cm. The height of the user's cheek pocket  
8 with jaws closed establishes the maximum vertical span of a fixed-  
9 span cheek-side stabilizing device because a greater fixed span  
10 would block full closure of the user's jaws. Whenever the user is  
11 capable of opening an inter occlusal space which exceeds the 1.75  
12 cm height of one of the user's dental arches then the potential  
13 will exist for a fixed-span cheek-side stabilizing device to rotate  
14 or translate between the biting surfaces of such user's teeth.  
15 Suppose the user's jaws open an inter occlusal space of 2 cm. Then  
16 the sum of that 2 cm inter occlusal space and the 1.75 cm height of  
17 one dental arch will total 3.75 cm, which exceeds the 3.5 cm  
18 maximum fixed span of a cheek-side stabilizing device that would  
19 permit that user's jaws to fully close, thereby potentially  
20 permitting a fixed-span stabilizing device to slip or rotate into  
21 that 2.0 cm inter occlusal space. Such an inter occlusal space  
22 might occur, for example, during a yawn or a cough. Of course, the  
23 hypothetical dimensions used above would vary from user to user,  
24 but the principle should apply to many potential users.

25        The instant invention's solution to the instability problem of  
26 fixed-span cheek-side positioning devices is to use a spring which  
27 resiliently expands and compresses within the user's cheek pouch as  
28 the user's jaws open and close. The expansion of the resilient  
29 cheek pouch anchor of the instant invention when a user's jaws open  
30 can usefully increase the stability of a cheek-side airway over  
31 that of a fixed-span cheek-side stabilizing device even if the  
32 resilient device is unable to expand the full vertical height of a  
33 user's maximum jaw opening. This is because most jaw openings are  
34 less than the maximum potential jaw opening.

#### 35 Lip-Sealing Problems.

36        Cheek-side airway tubes pass between a user's lips and thus  
37 can break the seal of the user's lips, permitting air passage

1 around rather than through the tube. This lip sealing problem  
2 tends to increase with increasing tube diameter and certain variant  
3 shapes. There are many prior art lip-sealing devices.

4 Mouth-Corner Flanges. Nelson's patents, and especially U.S.  
5 Patents 4,170,230 and 4,275,725, disclose modifications of Nelson's  
6 tube by flanges which engage the corner of a user's mouth and the  
7 user's lips for purposes of stabilizing the tube and sealing the  
8 user's lips.

9 Lip-conforming Tube Shapes. It is known that use of a tube  
10 lip portion which has an oval or somewhat flattened radial cross-  
11 section can improve sealing of the user's lips. That known  
12 solution can be employed in the instant invention.

#### 13 OBJECTIVES AND FEATURES OF THE INVENTION.

14 Objectives of this invention include the following:

15 An objective of this invention is to provide a relatively  
16 stable, supplemental ventilation pathway through a user's closed  
17 lips to the rear of the user's oral cavity which will remain open  
18 during closed-mouth, nasal breathing.

19 An objective of this invention is to provide supplemental air  
20 to a user's throat when a user's lips otherwise remain closed for  
21 the purpose of mitigating adverse effects of restricted nasal  
22 airways without requiring that the user switch from closed-mouth  
23 nasal breathing to open-mouth breathing.

24 An objective of this invention is to provide an airway passing  
25 from external air through a user's otherwise-closed lips to the  
26 rear of the user's oral cavity, while by-passing the user's jaws,  
27 tooth biting surfaces, and much of the user's tongue, including the  
28 more mobile forward portions of the user's tongue. In particular,  
29 it is an objective of this invention to provide an airway which can  
30 stabilize itself within in a user's cheek pathway without anchoring  
31 to a user's teeth, thus permitting opening and closing of the  
32 user's jaws without disruption of the airway's cheek pathway  
33 positioning.

34 An objective of this invention is that it not physically  
35 prevent or restrict a user from switching from closed-mouth nasal  
36 breathing to open-mouth breathing.

37 It is an objective of this invention that it provide one or

1 more passive air ways past closed lips which will remain  
2 relatively stable in a sleeping person, notwithstanding lip, jaw  
3 and tongue motions.

4 It is an objective of this invention that it have a shape and  
5 be positioned so as to minimize gagging or choking risk to a user  
6 of this invention, particularly while sleeping.

7 It is an objective of this invention that it remain relatively  
8 resistant to blockage of air flow openings by the cheek wall, gums,  
9 teeth, tongue or other tissue in a user's mouth.

10 It is an objective of this invention that it be capable of  
11 being placed so that it minimizes transmission of saliva or other  
12 mouth liquids through the airway past a user's lips.

13 It is an objective of this invention that it mitigate the "dry  
14 mouth" distress which many persons experience with open-mouth  
15 breathing by supplementing and preserving closed-mouth nasal  
16 breathing. It is an objective of this invention to deliver  
17 supplemental air directly to the rear of a user's oral cavity with  
18 a user's lips otherwise closed, minimizing air currents in more  
19 ventral portions of a user's mouth.

20 It is an objective of this invention that lay persons be  
21 capable of inserting, adjusting, using, and removing it by  
22 themselves.

23 It is an objective of this invention that it be adjustable to  
24 fit a particular user's comfort.

25 It is an objective of this invention that it be sanitizable by  
26 the same processes used for ordinary household eating utensils,  
27 such as dishwashing machines, or by the processes used for  
28 artificial dentures.

29 It is an objective of this invention to provide a supplemental  
30 air way to the rear of a user's mouth cavity which can function in  
31 combination with devices designed to control a user's tongue, tooth  
32 and/or jaw position, so the combination can cooperatively mitigate  
33 impaired breathing due to restriction of the user's nasal and  
34 throat airways. It also is an objective that the airway be  
35 compatible, and function in combination, with an anti-bruxing  
36 dental device. One useful effect, where such jaw-control or anti-  
37 bruxing devices block full closing of a user's jaws, is that such

1 devices can increase the cross-sectional area of a user's rear-jaw  
2 gaps which thereby more easily accommodate a larger diameter cheek  
3 path airway.

#### 4 Jaw-control and Tongue-Control Devices.

5 Examples of existing intra-oral, jaw-control and tongue-  
6 control devices with which it is conceived the invention might be  
7 used in combination (perhaps requiring some modification) are:  
8 Fenton, U.S. Pat. No. 5,499,633; Halstrom, U.S. Pat. No. 5,  
9 868,138; Strong, U.S. Pat. No. 6,418,933; Thornton, U.S. Pat. No.  
10 6325,064 B1; Meade, U.S. 6,055,986; Belfer, U.S. Pat. No.  
11 6,092,523; Frantz, U.S. Pat. No. 6,109,625; Bergersen, U.S. Pat.  
12 No. 6,129,084; Thornton, U.S. Pat. No. 6,155,262; David, U.S. No.  
13 6,450,167 B1; Tielmans, U.S. Pub. No. 2001, 0027793 A1 and U.S.  
14 Pat. No. 6,408,852 B2; Gaskell, U.S. Pub. No. 2002/0000230 A1; and  
15 Dort, Pub. No. US 2002/0117178 A1 (Aug. 2002). See also Thornton,  
16 U.S. Pat. No. 6,209,542 (nasal mask combined with dental device).  
17 Wagner, U.S. Patent 5,566,684 (1996) discloses a mouthguard which a  
18 user can self-fit to the user's maxillary dentition to mitigate  
19 nocturnal teeth grinding. An embodiment of Wagner's device, with  
20 instructions for self-fitting by users, is marketed under the trade  
21 name "The Doctor's Night Guard", by Dental Concepts, Paramus, N.J.,  
22 USA. There are advantages where a cheek-path airway is physically  
23 separated from the jaw-control and tongue-control devices, but  
24 designed to be used in a user's mouth in combination with such  
25 devices. The cheek-path airway then can be inserted or removed  
26 separately from the jaw- or tongue-control device, enabling  
27 separate handling of the cheek-path airway and such devices, such  
28 as separate fitting, adjustment, cleaning, and replacement.  
29 Moreover, it is conceived that existing jaw- and tongue-control  
30 devices which do include built-in airways could be simplified, and  
31 thus more readily constructed, if such built-in airways are deleted  
32 and their function replaced by a physically separate cheek-path  
33 airway adapted for combination use with such modified devices.

#### 34 BRIEF DESCRIPTION OF DRAWINGS

35 Figure 1 is an elevation view of a cheek path airway combined with  
36 a cheek pouch anchor.

37 Figure 2 is an elevation view of the same cheek path airway

1 combined with a cheek pouch anchor, as is Figure 1, but folded.  
2 Figure 3 is an elevation view of the side of a user's face showing  
3 a section view of the user's mouth, along Section 3-3 of Figure 3A,  
4 with the user's cheek removed, showing placement of a cheek path  
5 airway combined with a cheek pouch anchor.  
6 Figure 4 is a section view, along section 4-4 of Figure 4A, looking  
7 upward at the user's maxillary teeth and jaw with cheek path  
8 airways in place.  
9 Figure 5 is a perspective view of a cheek path airway and cheek  
10 pouch anchor approximately positioned relative to a dental device.  
11 Figure 6 is a perspective view of a dual cheek path airway folded  
12 into the approximate shape for placement in a user's cheek  
13 pathways.  
14 Figure 7 is a view of the same dual cheek path airway as in Figure  
15 6; but showing the airway in-line, with a zero curvature along its  
16 longitudinal axis, as manufactured but before folding the airway to  
17 fit a user's mouth.  
18 Figure 8 is a perspective view of a dual cheek path airway placed  
19 in cheek pathways in a user's mouth.  
20 Figure 9 is a second perspective view of a dual cheek path airway  
21 placed in cheek pathways in a user's mouth.  
22 Figure 10 is an elevation view of a user's face showing external  
23 airway stabilizing devices in place.  
24 Figure 11 is a perspective view of a user's face with mouth open,  
25 showing a dual cheek path airway with external stabilizing  
26 extensions in place.  
27 Figure 12 is a perspective view, from the upper left front, of a  
28 dual cheek path airway approximately positioned about an inverted  
29 (upside down), articulated, dental jaw-control device.  
30 Figure 13 is a perspective view, from the upper rear, of an  
31 articulated, prior art, dental jaw-control device.  
32 Figure 14 is a plan view of an inverted (upside down) dental jaw-  
33 control device with two single-cheek versions of the airway  
34 approximately positioned about it.  
35 Figure 15 is an elevation view of the side of a user's face,  
36 showing a section view along section 15 - 15 of Figure 15A with the  
37 user's cheek removed, and showing a cheek path airway placed about



1 a dental jaw-control device in the user's mouth.

2 Table of Drawing Elements

3 Cheek Path Airway Elements

- 4 1 external open tip of hollow tube, to be positioned external to  
5 user's lips
- 6 1a external open tip on second end of hollow tube in dual-cheek  
7 version of airway
- 8 2 lip portion of hollow tube, for traversing between user's lips
- 9 2a second lip portion of hollow tube in dual-cheek version of  
10 airway
- 11 3 cheek-side portion of hollow tube, to be positioned between  
12 inner side of user's cheek and cheek-adjacent (buccal) side  
13 of user's teeth and gums
- 14 3a second cheek-side portion of hollow tube in dual-cheek  
15 version of airway
- 16 4 rear-tooth corner portion of hollow tube; curved, or  
17 flexible, transition from cheek-side portion to jaw-gap  
18 portion of hollow tube, adjacent to rear-most tooth.
- 19 4a rear-tooth corner portion, curved, or flexible,  
20 transitioning from cheek portion to jaw-gap portion of  
21 hollow tube, adjacent to rear-most tooth in dual cheek  
22 version of airway.
- 23 5 rear-jaw gap portion of hollow tube (may be straight, or  
24 curved, or flexible)
- 25 5a Second rear-jaw gap portion of hollow tube in dual cheek  
26 version of airway.
- 27 6 Tongue portion of hollow tube, to extend from rear-jaw gap  
28 over user's tongue into user's rear mouth cavity (may be  
29 straight, or curved, or flexible).
- 30 6a Second tongue portion of hollow tube in dual cheek version  
31 of airway.
- 32 7 Rear-mouth cavity-spanning portion of hollow tube in dual  
33 cheek version of airway; joins first and second cheek-side  
34 portions 8 and 9 of dual cheek version.
- 35 8 First cheek-side portion of hollow tube in dual cheek  
36 version of airway, to traverse user's first cheek pathway on  
37 first side of user's mouth

1    9    Second cheek-side portion of hollow tube in dual cheek  
 2       version of airway, to traverse user's second cheek pathway  
 3       on second side of user's mouth.  
 4    10   air flow opening in first position in wall of external end  
 5       of hollow tube  
 6    10a   air flow opening in first position in wall of second  
 7       external end of hollow tube in dual cheek version  
 8    11   air flow opening in second position in wall of external end  
 9       of hollow tube  
 10   11a   air flow opening in second position in tube wall of second  
 11       external end of hollow tube in dual cheek version.  
 12   12   air flow opening in first position in tube wall of tongue  
 13       portion of hollow tube (tube portion 6)  
 14   12a   air flow opening in first position in tube wall of second  
 15       tongue portion of hollow tube (tube portion 6a) in dual  
 16       cheek version  
 17   13   Air flow opening in second position in tube wall of tongue  
 18       portion of hollow tube.  
 19   13a   Air flow opening in second position in tube wall of second  
 20       tongue portion of hollow tube in dual cheek version.  
 21   14   Air flow opening in third position in tube wall of tongue  
 22       portion near the center of the rear-mouth cavity in single  
 23       cheek version of airway; alternately, located in hollow tube  
 24       portion 7 in dual cheek version of airway.  
 25   15   Air flow opening in wall of hollow tube, in fourth position  
 26       in tongue portion of hollow tube near the center of the  
 27       rear-mouth cavity in single cheek version of airway;  
 28       alternately, located in hollow tube portion 7 in dual cheek  
 29       version of airway.  
 30   16   internal open end of hollow tube, located on tongue portion  
 31       of hollow tube in single cheek version of airway, to be  
 32       projected within airspace in user's rear-mouth cavity.  
 33   16a   internal open end of second hollow tube, located on second  
 34       tongue portion of second hollow tube in user's second cheek  
 35       pathway, when two single cheek versions used in opposite  
 36       cheeks.  
 37   17   lacing holes in cheek-side portion of hollow tube, adapted

1       to receive flexible, resilient filament 28 of cheek  
2       positioning device.

3   18       reserved  
4   19       reserved

5   Airway Retainer Elements

6   20       a first type of retainer on external end of hollow tube  
7   21       reserved

8   22       a second type of retainer, mouth-corner portion of hollow  
9       tube, to curve from lip portion 2 of tube about corner of  
10       user's mouth to outside wall of user's cheek

11   23       External cheek-side extension of hollow tube.

12   24       Flexible (or curved) portion of external cheek-side extension  
13       of tube

14   25       Flexible (or curved) ear piece of external extension of tube

15   26       Finger grip portion of ear piece.

16   27       Tape site on external cheek-side extension of hollow tube,  
17       for taping tube to user's face.

18   Cheek Pouch Anchor Elements

19   28       Flexible, resilient filament

20   28a       First (upper) loop in laced filament

21   28b       second (upper) loop in laced filament

22   28c       third (lower) loop in laced filament

23   28d       fourth (lower) loop in laced filament

24   29       First curled (or crimped) end of filament

25   29a       Second curled (or crimped) end of filament

26   User's Body Parts

27   30       user's upper lip

28   31       user's lower lip

29   32       inner wall of user's first cheek

30   32a       inner wall of user's second cheek

31   33       user's upper (maxillary) rear-most (dorsal) tooth on first  
32       side of user's mouth

33   33a       user's upper (maxillary) rear-most (dorsal) tooth on second  
34       side of user's mouth

35   34       lingual (tongue) side of user's rear-most upper (maxillary)  
36       tooth on first side of user's mouth

37   34a       lingual (tongue) side of user's rear-most upper (maxillary)

1           tooth on second side of user's mouth  
2   35    buccal (cheek-adjacent) side of user's rear-most upper  
3           (maxillary) tooth on first side of user's mouth  
4   35a   buccal (cheek-adjacent) side of user's rear-most upper  
5           (maxillary) tooth on second side of user's mouth  
6   36    user's upper jaw (maxilla) on first side of user's mouth  
7   36a   user's upper jaw (maxilla) on second side of user's mouth  
8   37    user's lower jaw (mandible) on first side of user's mouth  
9   38    user's rear-most (dorsal) lower (mandibular) tooth on first  
10       side of user's mouth.  
11   39    user's tongue  
12   40    roof of user's rear-mouth (oral) cavity  
13   41    airspace in user's rear-mouth (oral) cavity  
14   42    user's rear-jaw gap on first side of user's mouth  
15   42a   user's rear-jaw gap on second side of user's mouth  
16   43    Occlusal (biting) surface of user's tooth.  
17   44    User's palatal tonsil  
18   45    First corner of user's mouth (at juncture of upper and lower  
19       lips).  
20   45a   Second corner of user's mouth.  
21   46    External wall of user's first cheek  
22   47    User's first ear  
23   48    Lower side of user's first ear  
24   49    Upper side of user's first ear  
25   50    Dotted approximate outline of user's cheek pouch (showed  
26       with inner cheek wall removed)  
27   Dental Device Elements  
28   51    upper (maxillary) portion of dental device (showed upside  
29       down in some drawings)  
30   52    lower (mandibular) portion of dental device (showed upside  
31       down in some drawings)  
32   53    female (or sleeve) portion of adjustable strut of dental  
33       device  
34   54    male (or arm) portion of adjustable strut of dental device  
35   55    pivot bolt for mounting adjustable strut in maxillary  
36       portion of dental device  
37   56    pivot bolt for mounting adjustable strut in mandibular

1 portion of dental device  
2 57 collar of male (arm) portion of adjustable strut of dental  
3 device  
4 58 collar of female (sleeve) portion of adjustable strut of  
5 dental device  
6 59 wire reinforcing frame embedded in lower (mandibular)  
7 portion of dental device.  
8 60 wire reinforcing frame embedded in upper (maxillary) portion  
9 of dental device.  
10 61 series of teeth-engaging balls mounted on wire reinforcing  
11 frame 33 and projecting out of body of mandibular portion of  
12 dental device  
13 62 channel fitted to user's mandibular teeth  
14 63 channel fitted to user's maxillary teeth  
15 64 dental device, with channel fitted to user's teeth

#### 16 DETAILED DESCRIPTION OF DRAWINGS

17 Figure 1 shows a cheek path airway combined with a cheek  
18 pouch anchor. The cheek path airway is formed of a hollow tube  
19 (showed as manufactured in-line, with approximately zero  
20 curvature along its longitudinal axis), having external open tip  
21 1, lip portion 2, cheek-side portion 3, flexible rear-tooth  
22 corner portion 4, rear-jaw gap portion 5, tongue portion 6, air  
23 flow openings 10 and 11 in the tube wall placed adjacent to  
24 external open tip 1, and air flow openings 14 and 15 in the tube  
25 wall placed adjacent to internal open tip 16, with lacing holes  
26 17 through the walls of the cheek-side portion 3 of the hollow  
27 tube. Figure 1 also shows flexible, resilient filament 28,  
28 slidably laced through lacing holes 17 of the hollow tube, to  
29 form upper first loop 28a, upper second loop 28b bearing upper  
30 curled loop end 29, lower third loop 28c, and lower fourth loop  
31 28d bearing lower curled loop end 29a. Loops 28a, 28b, 28c and  
32 28d combine to form the whole loop span formed by the flexible,  
33 resilient filament 28. By tugging on curled loop ends 29 and 29a  
34 a user can lengthen loops 28b and 28d and shorten loops 28a and  
35 28c; conversely, by tugging on loops 28a and 28c a user can  
36 lengthen those loops while shortening loops 28b and 28d, thus  
37 enabling a user to adjust the whole loop span of filament 28 for

1 better fit.

2 Figure 2 shows the same cheek path airway combined with a  
3 cheek pouch anchor as in Figure 1, but with the flexible rear  
4 tooth-corner folded for positioning in a user's cheek pathway.

5 Figure 3 depicts a cheek path airway combined with a cheek  
6 pouch anchor and placed in a user's cheek pathway and cheek  
7 pouch. Figure 3 shows the hollow tube airway with external open  
8 end 1 in a position outside the user's lips, and lip portion 2  
9 passing between the user's upper lip 30 and lower lip 31. Figure  
10 3 shows cheek-side portion 3 of the hollow tube lying adjacent to  
11 the buccal side of the user's teeth, with rear-tooth corner  
12 portion 4 of the hollow tube flexed about the user's rear-most  
13 (dorsal) upper tooth 33 and lower tooth 38. It shows airway  
14 rear-jaw gap portion 5 passing through user's jaw gap 42,  
15 adjacent to user's tongue 39. It shows flexible, resilient  
16 filament 28 laced through lacing holes 17 in cheek-side portion 3  
17 of the hollow tube, and placed within the user's cheek pouch  
18 which is approximately outlined by the dotted line 50.

19 Figure 4 depicts a section view, along section 4-4 of Figure  
20 4A, looking upward at a user's upper (maxillary) jaw and teeth.  
21 It shows two variants of the single-cheek version of the airway  
22 placed in the user's two cheek pathways on opposing sides of a  
23 user's mouth. In the user's first cheek pathway, in the lower  
24 part of the drawing, the hollow tube has external open end 1,  
25 with added mouth-corner portion 22 flexed to curve about the  
26 corner of the user's mouth to act as a retainer element, external  
27 cheek-side portion 23 bearing a tape site 27 for taping the tube  
28 to a user's cheek, and air flow opening 11. Lip portion 2 of the  
29 hollow tube passes the user's upper lip 30, cheek-side portion 3  
30 passes between the user's inner cheek wall 32 and the buccal side  
31 of the user's teeth and gums, with rear-tooth corner portion 4 of  
32 the hollow tube flexed about the user's rear-most (dorsal), upper  
33 (maxillary) tooth 33, which tooth has a lingual side 34. Rear-  
34 jaw gap portion 5 of the hollow tube passes user's upper jaw  
35 (maxilla) 36 through the user's rear-jaw gap 42. Tongue section  
36 6 of the hollow tube projects internal open end 16 of the hollow  
37 tube into the airspace 41 in the user's rear-mouth cavity.

1 Adjacent to internal open end 16 is air flow opening 14 in the  
2 wall of the hollow tube. The upper portion of Figure 4 shows  
3 the user's second cheek pathway with a second airway in place.  
4 The second airway is modified with retainer 20 placed adjacent to  
5 the external open tip 1a, positioned outside of user's upper lip  
6 30.

7 Figure 5 depicts a cheek path airway approximately  
8 positioned about a dental device 64 which has a channel 62 to  
9 engage a user's lower teeth (or 63 if engaging user's upper  
10 teeth). The dental device 64 can be used to expand a user's  
11 rear-jaw gap, while also performing other functions such as an  
12 anti-bruxing device.

13 Figures 6 and 7 are comparative depictions of the same dual  
14 cheek path airway, except that in Figure 7 the airway's  
15 longitudinal axis has approximately zero curvature, as  
16 manufactured in-line. By comparison, in Figure 6 the airway has  
17 been folded after manufacture to approximate the shape necessary  
18 to fit into the cheek pathways in a user's mouth. Figures 6 and  
19 7 show a hollow tube having external open end 1 and adjacent air  
20 flow openings 10 and 11 in the tube wall; lip portion 2; cheek-  
21 side portion 3; rear-tooth corner portion 4; rear-jaw gap portion  
22 5; tongue portion 6 with flexible joints and with air flow  
23 opening 12 in the tube wall; and rear-mouth-cavity spanning  
24 portion 7 with air flow opening 15 in the tube wall. In the  
25 dual cheek path airway the rear-mouth-cavity spanning portion 7  
26 joins first cheek-side portion 8 (comprised of portions 1 through  
27 6) with second cheek-side portion 9 (comprised of portions 1a  
28 through 6a).

29 Figure 8 depicts a user's gaping mouth with a dual cheek  
30 path airway approximately placed. The view looks at a slight  
31 upward angle towards the user's upper teeth including rear-most  
32 tooth 33 having lingual side 34 and buccal side 35 with rear-  
33 tooth corner portion 4 curved about rear-most tooth 33. Figure 8  
34 depicts rear-jaw portion 5 of the airway passing through the  
35 user's rear-jaw gap 42. It also depicts airway portions 6 and 7,  
36 with air flow openings 12 and 14 positioned above the user's  
37 tongue 39, in the airspace 41 of the user's rear-mouth cavity

1 adjacent the roof 40 of the user's mouth, ventrally of the user's  
2 palatal tonsil 44. The depicted placement of the cheek path  
3 airway is somewhat distorted, relative to the user's mouth parts,  
4 from where the airway would typically lie when the user's mouth  
5 is in a less gaping position.

6 Figure 9 is the same as Figure 8 except that the view is at  
7 a slightly more downward angle enabling a view of the user's  
8 lower teeth and a less obstructed view of the rear of the user's  
9 mouth, including palatal tonsil 44. This view also somewhat  
10 distorts the positioning which the airway would have relative to  
11 the user's mouth parts if the user's mouth were in a less gaping  
12 posture.

13 Figure 10 shows a front and side perspective view of a  
14 user's face with a dual cheek path airway in place and the user's  
15 lips closed. The airway projects out through the user's lips,  
16 near the corners 45 and 45a of the user's mouth, with external  
17 air flow opening 10 adjacent to the user's lips. The second type  
18 of retainer, mouth-corner portion 22 of the hollow tube, curves  
19 about the corner 45 of the user's mouth. External cheek-side  
20 extension 23, having flexible joint portion 24, lies along the  
21 outside of the user's cheek 46. Flexible ear piece 25 is curved  
22 about the lower side 48 and the upper side 49 of the user's ear  
23 47, and the airway's ear piece 25 terminates in finger grip  
24 portion 26.

25 Figure 11 depicts a user's face and open mouth with a dual  
26 cheek airway in place, where the airway has external stabilizing  
27 parts, including mouth-corner portion 22, external cheek-side  
28 extension 23 with flexible joint 24, and ear piece 25 with finger  
29 grip portion 26.

30 Figure 12 depicts a frontal and side perspective view of a  
31 dual cheek path airway folded about a dental jaw-control device  
32 in a very rough approximation of the relationship that the airway  
33 would have to the dental device in a user's mouth, with the  
34 airway passing behind the dental device and around the outside of  
35 the struts of the dental device. For convenience the dental  
36 device is depicted upside down and is articulated to better  
37 display its parts. The dental device has a mandibular (lower



1 jaw) portion 52 and a maxillary (upper jaw) portion 51, which are  
2 connected by adjustable struts on either side. The struts have  
3 female (sleeve) portion 53 which slidably receives male (arm)  
4 portion 54. The struts have collars 57 and 58 which are  
5 rotatably mounted on pivot bolts 55 and 56. Pivot bolt 55 is  
6 rigidly mounted near the dorsal end of maxillary portion 51, and  
7 pivot bolt 56 is rigidly mounted near the ventral end of  
8 mandibular portion 52. Mandibular portion 52 and maxillary  
9 portion 51 typically are formed of plastic cast in molds  
10 imprinted by a user's mandibular and maxillary teeth. Wire  
11 reinforcing frames 59 and 60, as well as seats for pivot bolts 55  
12 and 56, are embedded in the plastic casts which form mandibular  
13 portion 52 and maxillary portion 51. The embedded reinforcing  
14 wire frames 59 and 60 are visible because the plastic in which  
15 they are embedded is clear. Figure 12 depicts the dual cheek  
16 path airway with flexible rear-tooth corner portion 4 of the  
17 airway folded to project cheek-side portion 3 around the outside  
18 of the strut of the dental device, and to project rear-jaw-gap  
19 portions 5 of the airway about the dorsal corners of the dental  
20 device. Flexible joints in tongue portion 6 and rear-mouth-  
21 cavity spanning portion 7 of the airway curve about the dorsal  
22 side of the dental device.

23 Figure 13 depicts from a dorsal perspective the same dental  
24 jaw-control device as that depicted in Figures 12 and 13 in  
25 combination with cheek path airways. The dental device is  
26 depicted upside down to expose the teeth-engaging channel 62 of  
27 mandibular portion 52 which is cast from a mold of a user's  
28 mandibular teeth. The embedded wire reinforcing frame projects a  
29 series of teeth-engaging balls 61 out of the plastic cast  
30 adjacent to the buccal wall of teeth-engaging channel 62.  
31 Figure 13 also depicts another view of the wire reinforcing frame  
32 60 embedded in the clear plastic cast which forms maxillary  
33 portion 51 of the dental device. The entire dental jaw-control  
34 device depicted in Figure 13 is prior art, but is depicted in  
35 order to show additional aspects of the dental device with which  
36 the cheek path airway can be combined.

37 Figure 14 is a plan view depicting two single-cheek versions

1 of the airway approximately positioned about the same dental jaw-  
2 control device as is depicted in Figures 12 and 13. Figure 14  
3 shows rear-tooth corner portion 4 of the airway flexed about the  
4 dorsal corner of the dental device, projecting rear-jaw gap  
5 portion 5 and tongue portion 6 of the airway about the dorsal  
6 side of the dental device and projecting cheek-side portion 3  
7 around the outside of the struts of the dental device, in  
8 approximately the positions which the airways would have relative  
9 to the dental device when both are in place in a user's mouth  
10 with the user's jaws closed.

11 Figure 15 is a side view of a user's face, along section 15  
12 - 15 of Figure 15A, with the user's cheek removed. It shows a  
13 cheek path airway placed in a user's cheek pathway so as to  
14 operate cooperatively with a dental jaw-control device which also  
15 is in place in the user's mouth. Maxillary portion 51 of the  
16 dental device is engaging the user's maxillary teeth and  
17 mandibular portion 52 is engaging the user's mandibular teeth,  
18 with pivot bolt 56 disposed more ventrally on mandibular portion  
19 52 and pivot bolt 55 disposed more dorsally on maxillary portion  
20 51 so that the user's mandibular jaw is urged ventrally relative  
21 to the user's maxillary jaw. The purpose is to prevent the  
22 user's mandibular jaw from sagging dorsally towards the user's  
23 throat when the user is lying more or less supine during sleep.  
24 The dental device also can serve an anti-bruxing function. A  
25 cheek path airway is placed around the dental device with cheek-  
26 side portion 3 of the airway positioned outside the strut (sleeve  
27 53 and arm 54) of the dental device. The rear-tooth corner  
28 portion 4 of the airway curves about the dorsal corner of the  
29 dental device, and rear-jaw gap portion 5 of the airway projects  
30 dorsally of the dental device. In this configuration the user  
31 can open and close the user's jaws, operating the slidable sleeve  
32 53 and arm 54 of the dental device while the collars of the strut  
33 rotate about pivot bolts 55 and 56. When placed in a cheek  
34 pathway the inner wall of the user's cheek (not shown in Figure  
35 15) drapes over and presses against the relatively rigid cheek-  
36 side portion 3 of the airway while the relatively rigid lip  
37 portion 2 of the airway projects between the user's lips 30 and

31. Pressure of the user's inner cheek wall and mouth corner (not shown in Figure 15) urges portion 3 of the airway against the strut (sleeve 53 and arm 54) of the dental device, helping constrain pitch and yaw rotation of the airway. Sleeve 53 and arm 54 of the dental device also prevent cheek-side portion 3 of the airway from slipping laterally between the maxillary and mandibular portions 51 and 52 of the dental device when the user's jaws open.

#### Preferred Embodiments of Invention.

Airway Tube. In a preferred version, the cheek path airway is formed as a relatively rigid tube with flexible joints interspersed at strategic positions along the tube's longitudinal axis. The more rigid sections of the tube provide structural stability and better leverage to avoid the biting surfaces of a user's teeth, as well as to better project the internal and external open ends of the airway into desirable locations. By reference to Figures 3, 4, and 15, the user's inner cheek wall (labeled 32 in Figure 4, not shown in Figures 3 and 15), drapes over and provides cheek-side pressure upon cheek-side portion 3 which is relatively rigid along the longitudinal axis. By reference to Figure 15 the draping effect of the user's cheek (not shown) urges cheek-side portion 3 against sleeve 53 and arm 54 of the strut of the dental device, constraining rear-tooth corner portion 4 and rear-jaw gap portion 5 of the tube from yawing into the inter occlusal space between mandibular portion 52 and maxillary portion 51 of the dental device. By reference to Figure 3, the draping effect of the user's cheek (not shown) presses against both rigid cheek-side portion of the airway and against the cheek pouch anchor, again constraining yawing of rear-tooth corner portion 4 and rear-jaw gap portion 5.

In-Line Manufacture of Airway Tube. The airway tube, including the flexible joints, preferably is manufactured "in-line," that is, with near-zero curvature in the longitudinal axis of the tube, as in Figures 1 and 7. Such near-zero curvature during manufacture will ease manufacture, packaging, transportation, storage and retail display of the airway, while the interspersed flexible joints enable a user to shape the tube

1 along its longitudinal axis to fit the user's mouth, as in  
2 Figures 1, 6 and 8-11.

3 A modification of the instant cheek airway is designed to  
4 enable incorporation of a mouth-corner retainer element in a  
5 single, in-line manufacturing process by simply extending length  
6 of the hollow tube with flexible joints inserted to enable the  
7 tube to fold about the corner of a user's mouth and along the  
8 outer wall of a user's cheek, depicted as element 22 in Figures  
9 4, 10 and 11. The tube can even be manufactured in-line with  
10 sufficient length to curve about a user's ears, as element 25 in  
11 Figures 10 and 11. Adaptation of the hollow tube for in-line  
12 manufacturing is preferred to eliminate the necessity to add  
13 flanges by some additional assembly process, and has the added  
14 features of easier packing, shipping and display, while enabling  
15 the end user to fold the in-line tube for better personal fit.

16 Tongue-Avoiding Feature. In one preferred modification of  
17 the cheek airway invention, at least one of the rear-tooth corner  
18 4, the rear-jaw gap portion 5 and the tongue portion 6 of the  
19 airway is stiffly flexible so that a user's tongue can press the  
20 airway into locations of lesser interference with the user's  
21 tongue, near the side and roof of the user's rear-mouth cavity.  
22 Not only does the resulting configuration reduce interference  
23 with the user's tongue, but also it can help retain the airway  
24 in the user's cheek pathway.

25 Tube Diameters Related to Rear-jaw Gap and Lip Seal. By  
26 comparison to the 2 to 3 mm inside diameter which is explicitly  
27 disclosed for the pressure-equalization conduit of Pope, et al.,  
28 U.S. Patent 4,553,549, larger diameters are preferred for the  
29 instant invention, to the extent that the user's rear-jaw gap can  
30 accept such larger diameters; larger diameters enable the higher  
31 flow volumes desired for the breath-supplementation function of  
32 the instant invention. By way of non-limiting example, tube  
33 inside diameters of approximately 5.5 mm to 6.5 mm, have been  
34 used in the instant invention for an adult human. The instant  
35 invention is not specifically limited to such range of diameters,  
36 but rather it typically will be limited by the cross-sectional  
37 area of the particular user's rear-jaw gap.

1 Lip-sealing problems can be mitigated in the instant  
2 invention by employing a smaller diameter tube around which a  
3 user's lips still can nearly seal. When using such smaller  
4 diameter tubes, one accepts that the resulting lesser air flow  
5 through the cheek path airway may only supplement, not entirely  
6 replace, nasal breathing. However, lip sealing tends to be a  
7 less critical issue in the instant invention because the  
8 invention is founded in part upon a recognition that there can be  
9 benefit to preservation of some nasal air flow by using a cheek  
10 path airway merely to supplement nasal air flow rather than  
11 replacing it; as a result a tube smaller than the diameter tube  
12 required to completely replace nasal breathing can be employed to  
13 more readily allow the user's lips to seal about the tube.

14 In many instances the maximum radial cross-section of a tube  
15 which can be fitted to a user's rear-jaw gap also will be small  
16 enough to allow the a user's lips to seal around the instant  
17 cheek airway tube sufficiently to render lip sealing an  
18 insignificant issue. While it is desirable in the instant  
19 invention to preserve a user's normal lip seal when the user is  
20 breathing nasally, the instant invention is designed to not  
21 prevent and not hinder open-mouth breathing when the user's  
22 physiologic state naturally triggers a switch from nasal to open-  
23 mouth breathing. When supplementing nasal air flow, the instant  
24 invention does not necessarily require a strict lip seal, but it  
25 is desirable to enable a user to substantially preserve the  
26 user's natural lip seal.

#### 27 Methods of Making and Using.

28 The cheek path airway can be manufactured from plastic  
29 materials such as those in use for flexible drinking straws,  
30 provided that they be essentially non-toxic. It is conceived  
31 that the cheek path airway could be manufactured by modification  
32 of methods and machines presently widely used for the manufacture  
33 of flexible drinking straws.

34 Portions of a relatively rigid tube can be rendered flexible  
35 by imposing corrugations in the tube wall similar to those which  
36 render plastic drinking straws flexible. Such corrugations can  
37 render a tube somewhat extensible as well as flexible. A wide

1 variety of methods could impart the essential curves to fit a  
2 user's cheek path. For example, portions of the tube could be  
3 rendered flexible by helical coils of wire or filament covered by  
4 an outer sheath; or semi-rigid, semi-flexible tubing could be  
5 used throughout and adjusted by hand molding to fit a cheek  
6 pathway. Materials of differing flexibility could be fused or  
7 welded together. The degree of flexibility versus rigidity could  
8 be altered by controlling the thickness of the tube walls and  
9 their chemical composition.

10 The thickness of the walls of plastic tubes can be adjusted  
11 to enable such tube walls to deform to a flattened or oval shape,  
12 which better conforms to the cross-section of a particular user's  
13 rear-jaw gap, but without collapse of the hollow air passageway.  
14 The deformation can be flexible or malleable, as well as  
15 resilient. For comfortable fit, it is preferable that the outer  
16 surface of the rear-jaw gap portion of the airway tube be  
17 smooth, rather than corrugated, to minimize irritation when the  
18 jaws close the rear-jaw gap to its minimum cross-section.

19 Airflow openings and filament-lacing holes can be melted  
20 through the walls of plastic tubes by use of a heated pointed  
21 instrument. It is conceived that the tube walls could be  
22 initially formed with such openings, or openings could be cut or  
23 stamped, or formed with a focused laser beam.

24 It is conceived that in a combination of the cheek pouch  
25 anchor with the cheek path airway, much of the stabilizing  
26 function can be assumed by the anchor, permitting a wider range  
27 in the design of flexibility and rigidity in the tube.

28 The filament used in the cheek pouch anchor can be  
29 manufactured from monofilament plastic line similar to that in  
30 common use for heavier weights of fishing line, provided that it  
31 be essentially non-toxic. Flexibility and resilience can be  
32 controlled by controlling the size of the cross-section of the  
33 monofilament, as well as its composition. It is conceived that  
34 flexibility and resilience also could be affected by changes in  
35 the shape of the monofilament's cross-section. Such monofilament  
36 line can be heat-molded at relatively low temperatures into  
37 curves of the desired shapes and it develops a "memory" for such

1 a heat-molded shape which aids shaping of spring-like curves in  
2 the monofilament line. Altering the locations of the lacing  
3 holes 17 in portion 3 of the airway tube alters the shape of the  
4 curves in the cheek pocket anchor.

5 The cheek path airway, the cheek pouch anchor, and the  
6 combination of them, can be sanitized in an ordinary household  
7 dishwasher in the same manner as dining utensils, provided that  
8 temperatures in the machine are not so high as to excessively  
9 soften the materials of the devices.

10 Because all parts can be formed of plastic, it is conceived  
11 that the cheek path airway, and possibly the combination of the  
12 cheek path airway and cheek pouch anchor, could be manufactured  
13 and assembled sufficiently inexpensively for short term use and  
14 possibly to be disposable.

15 Some Definitions Used in the Claims.

16 For purposes of the claims the following words have the following  
17 meanings:

18 "Conduit" means a hollow tube or channel capable of conveying  
19 fluids along its longitudinal axis, which axis may be curved. A  
20 conduit may have one or more separate passageways through it and  
21 thus have a plurality of longitudinal axial dimensions. The  
22 conduit's cross-section may be enclosed (as in a tube by way of non-  
23 limiting example), or partially open (as in an open-top channel  
24 by way of non-limiting example). The conduit's radial cross-  
25 section may have a single-focus radius (circular cross-section)  
26 or may have multi-focal radii or variable length radii and thus  
27 have a plurality of radial dimensions (oval or other variant  
28 shape which can include multi-lateral shapes, that is, a  
29 plurality of sides). A conduit's radial cross-section may vary  
30 along the conduit's longitudinal axis.

31 "Curve" means a geometric figure which may have any degree of  
32 curvature; it may but need not include zero curvature, that is, a  
33 straight line, as well as positive or negative curvature.

34 "Filament" includes at least one thread, fibre, strand, wire,  
35 line, string, strip, or the like. It may include multi-strand or  
36 braided configurations. The radial cross-section of the filament  
37 may, but need not necessarily be, circular.

1 "Flexible" includes bendable, pliable, moldable, and adjustable.  
2 "Portion" of a conduit refers to an approximate functional  
3 location or position along the longitudinal axis of the conduit,  
4 without necessarily implying sharp or distinct boundaries between  
5 portions and functions; one portion may have an indistinct or  
6 blended joiner with another portion, and when the conduit is  
7 installed in a user's mouth a portion may conform only  
8 approximately to the indicated parts of a user's mouth.